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A NEW FLIGHTLESS SPECIES OF *AULACOPRIS* WHITE FROM NORTH QUEENSLAND (COLEOPTERA : SCARABAEIDAE : SCARABAEINAE)

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ABSTRACT

Aulacopris matthewsi sp. nov. is described from mountains behind Cape Tribulation in northern Queensland. Its nearest relatives are in southeastern Queensland. The species is the smallest in the genus and is flightless. Individuals engaged in ball making and ball rolling activities in the laboratory.

INTRODUCTION

The genus *Aulacopris* White includes the largest Australian Scarabaeinae. Matthews (1974) recognized two species, the type species *reichei* White and a new species, *maximus*. Both species are winged and known from coastal areas of southeastern Australia — *reichei* from *Casuarina* coastal forest on sandy soil from Sydney south to Mallacoota in north eastern Victoria, and *maximus* in montane localities from Barrington Tops in central New South Wales north to Eumundi in southern Queensland (Matthews 1974), with *reichei* being taken recently near Warburton in southern Victoria (T. Weir, pers. comm.). This paper describes a third, much smaller, flightless species from northern Queensland, about 1350 km north of the previous northern record for the genus.

QM = Queensland Museum.

Aulacopris White

Aulacopris White 1859, *Proc. zool. soc. Lond.* p.118.

Type species: *Aulacopris reichei* White, 1859.

Aulacopris matthewsi sp. nov. (Figs. 1-3).

MATERIAL EXAMINED

HOLOTYPE: QM T8720 ♂, 3.5 km W of Cape Tribulation, 680 m (site 7), NE Qld., i. 1983, G.B. Monteith.

ALLOTYPE: QM T8721 ♀. Same data as holotype.

PARATYPES (42): Same data as holotype, (15 ♂♂, 19 ♀♀); same locality 23.ix.-7.x.1982, Monteith, Yeates and Thompson, (2 ♂♂, 2 ♀♀); same locality 20-23.iv.1983, G.B. Monteith and D.K. Yeates, (2 ♀♀). 3.0 km W of Cape Tribulation, 500 m (site 6), 5-9.i.1983, G.B. Monteith, (1 ♂), 4.0 km W of Cape Tribulation, 720 m (site 8), 5-9.i.1983, G.B. Monteith, (1 ♂).

(Paratypes in Queensland Museum, ANIC Canberra, British Museum (Natural History) London, South Australian Museum, Queensland DPI, Colls. R.I. Storey, Mareeba; H.F. Howden, Ottawa; A. Walford-Huggins, Julatten; P. Allsopp, Toowoomba; G. Williams, Taree).

DESCRIPTION

Total length 7.9–11.2 mm, colour uniformly piceous, surface sericeous except where noted.

MALE

Head: Clypeal teeth short, acute, broadly emarginate between, rest of margin feebly convex to genal angles which are quadrate, apices rounded. Surface covered with large, indistinct, shallow, ocellate punctures, regularly spaced, separated by 1 diameter or less, each with a short recurved seta. Small nitid area in front of clypeal teeth with simple punctures. Dorsal portion of eyes about 10 facet rows wide, separated by about 10 eye widths.

Pronotum: Anterior angles quadrate, apices rounded, posterior margin in major male with a long narrow, almost parallel sided process, the tip of which is bifurcate, reduced to a slight point in minor males, posterior and laternal margins feebly serrate. Lateral margins flattened, disk strongly convex, anteriorly humped, the hump with a strong elongate central tumescence, flanked by a pair of rounded, slightly anterior tumescences in major male, the central one very nitid, impunctate, the lateral ones nitid, punctate, a shallow, lanceolate depression in front of process on posterior margin. Surface of disk with

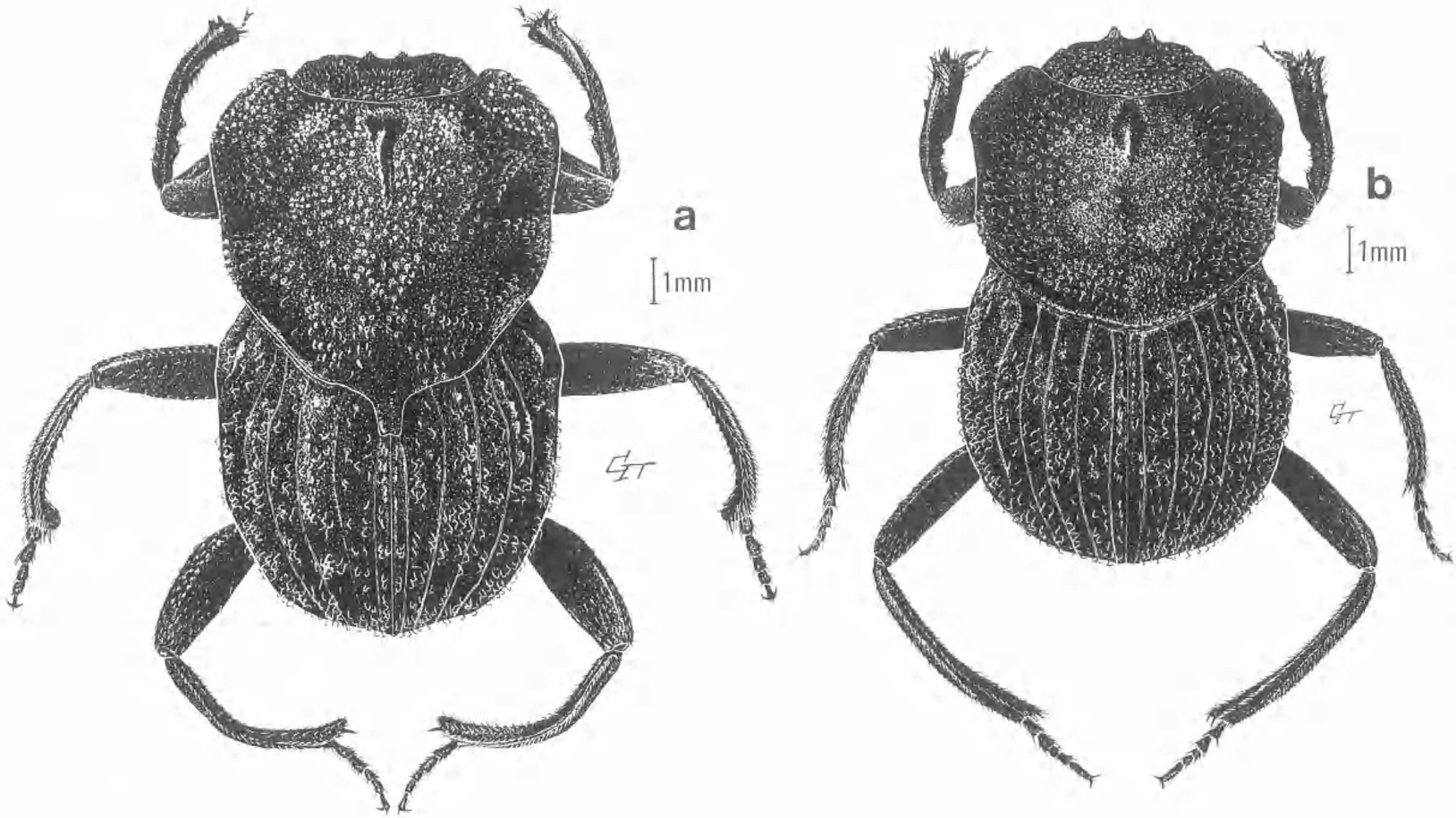


FIG. 1: *Aulacopris matthewsi* sp. nov. (a) paratype male (b) paratype female.

ocellate punctures scattered irregularly over surface, separated by 1–4 diameters, each puncture with a short recurved seta.

Elytra: Surface convex, uneven, raised near bases of 3rd, 5th and 7th intervals, shallow depressions at bases of 1st and 5th intervals. Pseudepipleura outside 7th stria carinate, reduced to about 1/4 the length of the elytra, a slight swelling near apex of 5th and 6th intervals. Striae fine, superficial, numbers 6–9 largely effaced though sections distinct. Odd numbered intervals with a few small tubercles, the apices of which are nitid, all intervals with groups of fine punctures, each with a short recurved seta.

Hind wings: Reduced to 2/3 length of elytra.

Sterna: Mesosternum about 4 times as wide as long, with scattered indistinct, ocellate punctures with short setae. Metasternum of major male with prominent fossa, starting at the mesometasternal suture, directed dorsally and backwards for about half the length of the metasternum and a quarter of the way through the beetle. The posterior edge of this pit is pulled up and curled back to form a prominent protuberance with a truncate and feebly bifurcate apex. Pit and protuberance reduced to a shallow nitid depression and low tubercle in minor males. Rest of surface of metasternum with scattered indistinct ocellate punctures and recurved setae.

Legs: Fore femur broad, width about 1/2 length at maximum, anterior margin bluntly serrate with a strong broad tooth about 2/3 of distance to tibia, fore tibia narrow and curved inwards for last 1/3, outer margin with 2 strong teeth near apex, plus a much smaller more posterior one, distal edge with a sharp downward facing tooth, inner margin bluntly serrate, with a triangular tooth 1/3 of distance from base and a sharp tooth at apex, apex nitid, fore spur long, narrow, pointed, about length of short tarsi. Mid tibia narrowed with inner apex slightly flattened, rounded, nitid. Hind tibia long, narrow, curved inward in apical 1/3, inner apex lengthened, flattened, nitid. Mid and hind tarsal segments widened towards apex, 1st segment longer than 2nd, 3rd or 4th, almost length of 5th.

Abdomen: Pygidium slightly convex, with ocellate punctures and recurved setae. Ventrites compressed, 6th being almost as wide in middle as first 5 combined, with ocellate punctures and recurved setae on basal edge of each ventrite, over most of surface of 6th. Aedeagus with parameres asymmetrical, as in Fig. 3.

FEMALE

Clypeal teeth closer together, more prominent, punctures more distinct. Hind edge of pronotum not produced into a parallel sided process, anterior hump indistinct, lateral tumescences of pronotal disk effaced though feebly nitid. Metasternum flat, unsculptured with numerous ocellate punctures with short setae, anterior central section nitid with fine puncutres and setae. Tooth on for femur longer and narrower, fore tibia straight, apical 2/3 wide, parallel sided, basal 1/3 of inner margin concave, bluntly serrate with a short wide blunt tooth just before base, inner apical tooth and downward facing tooth absent, teeth on outer margin slightly more prominent. Mid and hind tibiae without inner apices modified, mid tibia slightly wider and hind tibia less curved than in male. Abdomen not as compressed. Otherwise as in male.

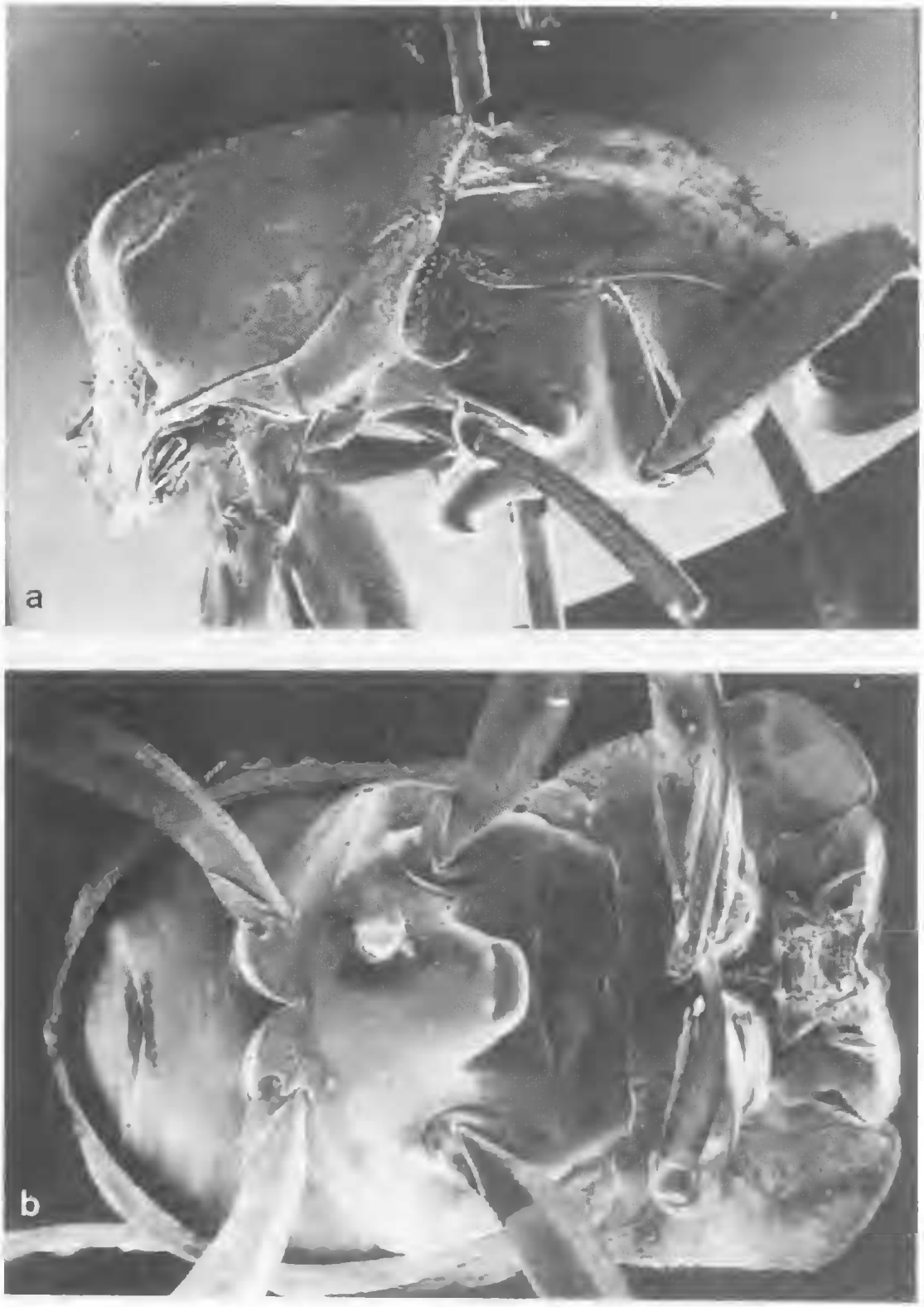
COMMENTS

This unusual species is known only from the type locality, an eastern ridge of Mt. Sorrow, behind Cape Tribulation, about 100 km north of Cairns in north Queensland. All 44 specimens were obtained in a survey of ten sites, from sea level to close to 800 m, along a transect running through continuous rainforest from the Cape to Mt. Pieter-Botte, about 7 km inland (Fig. 4). This survey, undertaken by Dr G.B. Monteith of the Queensland Museum, involved sampling for insects using various techniques. All specimens of *A. matthewsi* were taken in dung baited pitfall traps. Only sites 6, 7 and 8, at altitudes between 500 m and 720 m, yielded *matthewsi*, all but two specimens being from site 7. The rainforest at these sites is described by Tracey and Webb (1975) as Simple Microphyll Vine-Fern Thicket.

Difficulty may be experienced in running *matthewsi* to *Aulacopris* in Matthews' (1974) key to the genera of Australian Scarabaeini due to the reduction of the pseudepipleura and elytral tubercles and the lack of pronotal carinae. However, both the pseudepipleura and tubercles are present on the elytra, and the eye canthus is complete, a combination which eliminates all other genera. Other differences from Matthew's synopsis of the genus are: small size (7.9–11.2 mm as opposed to 16–30 mm); reduction in hindwings resulting in flightlessness; 1st segment of mid and hind tarsi longer than 2nd; abdomen compressed and shortened. A modified version of Matthews' (1974) key separates the three species.

KEY TO THE SPECIES OF *AULACOPRIS*

1. Pronotum without prominent, sharp carinae. First segment of mid and hind tarsi longer than second. Flightless species, total length 7.9-11.2 mm. N. Queensland..... .....*matthewsi* sp. nov.


a
b

Pronotum with prominent, sharp carinae. First segment of mid and hind tarsi shorter than second. Fully winged species, total length 16-30 mm. SE Australia 2

2. Basal half of inner edge of fore tibia simple. Clypeal teeth separately produced, the edge to either side of them convex. Pronotal carinae and elytral tubercles very prominent. Elytral striae distinct, even-numbered intervals with irregular surface. Total length 16-21 mm. Victoria, New South Wales..... .....*reichei* White

Basal half of inner edge of fore tibia with 2 prominent teeth enclosing a large rounded excision. Clypeal teeth not separately produced, the edge to either side of them straight. Pronotal carinae and elytral tubercles less prominent, striae obsolescent, even-numbered intervals plane. Total length 22-30 mm, N. New South Wales, S. Queensland .....*maximus* Matthews

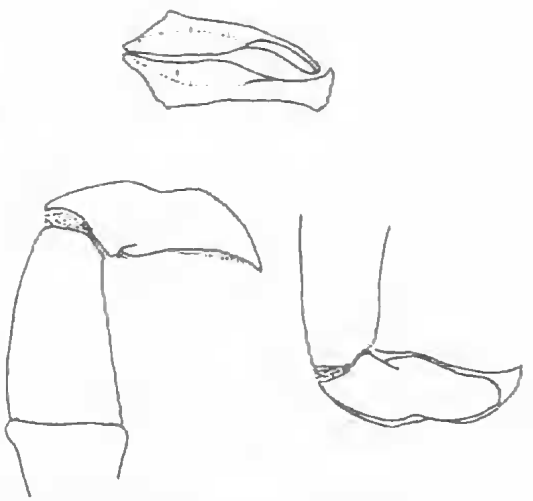


FIG. 3: Aedeagus, *A. matthewsi* sp. nov.

ETYMOLOGY

The species is named after Dr E.G. Matthews, without whose work on the taxonomy of Australian Scarabaeinae, none of the current work would be possible.

BALL FORMATION AND BALL ROLLING BEHAVIOUR

Nine specimens (1 ♂, 8 ♀♀) of *A. matthewsi* from the January, site 7 collection were returned alive to the laboratory in Mareeba for behavioural studies. These were kept alive for about one month in a large container with about 10 cm of soil in the bottom and were fed fresh horse dung at weekly intervals. The beetles took readily to the dung, feeding on its surface, making balls and rolling these around the container. However, they made no effort to fashion nests of any sort, either directly in the soil or under pieces of wood and leaf litter provided. The balls were merely abandoned, the beetles spending the remaining time walking around the container or usually buried in the soil beneath the dung. The soil was changed at one stage from the original sand/peat mixture to a local red volcanic type with no resulting change in behaviour. The single male was very inactive taking no interest in either ball formation or the females. According to Dr Monteith, some at least of the beetles came to traps in the daylight hours and all observations in the laboratory were made during these hours. Many balls were made overnight, however, so it is likely the beetles are active at all hours that food is available.

Typical ball formation was as follows: the beetle stands on top of the dung mass, and starts to press back with the forelegs on a section of dung while pushing outwards with the edge of the clypeus. The beetle slowly rotates until a rough ball about 2/3 the length of the beetle is formed and pinched off. Ball and beetle fall to the ground where the beetle continues to work on the ball, compressing it with the forelegs and removing larger bits of undigested grass. The beetle then starts enlarging the ball by dragging more material off the main dung mass and pressing it into the ball. At completion the ball is spherical and slightly larger than the beetle. This process takes about 2 hours.

Individuals rolled these balls around the enclosure and did the same with small cylindrical ones made by the author. Rolling is done using a head down position, balancing on the side of the ball with the mid and hind legs while stretching out and pushing on the substrate with the head and occasionally the forelegs, thereby rolling the ball a few millimetres backwards. After relaxing the body to the unstretched condition it walks further round the ball to get closer to the substrate. This combination of walking forward over the ball and pushing with the head results in a very slow progress backward.

FIG. 2: *Aulacopris matthewsi* sp. nov. (a) major male, side view (b) major male, ventral view.

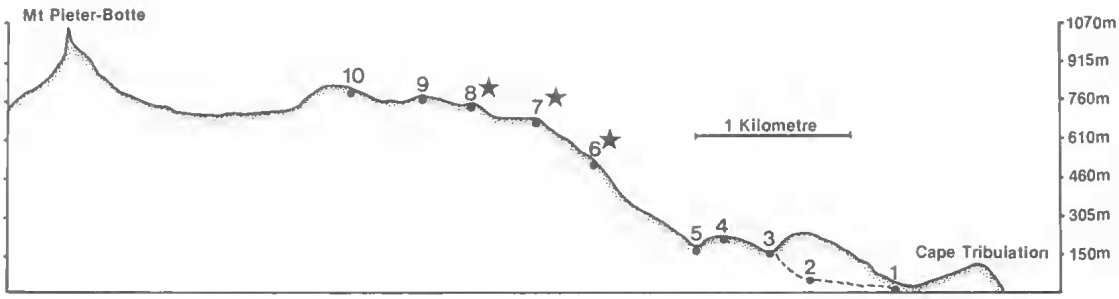


FIG. 4: Cape Tribulation sampling transect showing position of collecting sites. Asterisks indicate sites at which *A. matthewsi* was collected.

DISCUSSION

Aulacopris matthewsi sp. nov. is the second species of a 'southern' genus of the tribe Scarabaeini discovered recently on north Queensland mountain tops, the first being *Aptenocanthon monteithi* Storey found somewhat to the south of *matthewsi*, on the Bellenden-Ker Range and nearby mountains (Storey 1984). Like *Aptenocanthon, Aulacopris* is included in the mentophiline group of genera within the subtribe Canthonina, which can be distinguished from other Australian canthonines by the presence of pseudepipleura on the elytra and simple tarsal claws. The importance of southern genera of Scarabaeini being found in mountainous areas of north Queensland was discussed in that paper and will not be repeated here.

A. matthewsi is the first known flightless member of the genus *Aulacopris*. Wing reduction is relatively common in Australian Scarabaeini with close to 50% of known species being flightless and 14 of the 16 genera containing flightless species. Matthews (1974) discusses wing reduction of Australian Scarabaeini in some detail, attributing the relatively high occurrence to environmental stability and limitation of habitat area and this is undoubtedly the situation in *matthewsi.*

One of the most remarkable features of *A. matthewsi* is the massive sternal fossa and associated tubercle in the major male. This fossa displaces much of the internal volume of the mesothorax in extreme examples. It is difficult to speculate on the purpose, if any, of this structure at present. Similar though much less developed features are found on males of *A. reichei* and *A. maximus.*

Dung beetles of the tribe Scarabaeini have a unique method of utilizing dung as a food supply. In nearly all species studied, a small portion of dung is taken from a larger mass, formed into a ball and rolled, using either a pulling (Position I) or pushing (Position II) position, to a place well away from the original source (Halffter and Matthews 1966). Here the ball is usually buried and either consumed by the beetle or used in the manufacture of brood balls. Little has been recorded on the behaviour of Australian genera, however, other than the enigmatic *Cephalodesmius* which was studied in detail by Monteith and Storey (1981). Matthews, at the time of his revision (1974) had not seen any of the mentophilines fashion balls from a dung mass, in spite of observations both in the field and in captivity on several of the genera, including *Aulacopris* (*reichei*). This prompted him to speculate that this primitive group of genera was at a stage of evolution preceding ball making. However, Waite (1898) reported *A. maximus* (cited as *reichei*) as having made brood balls from bat guano, found containing immatures at various stages of development. Since then *maximus* has been seen to construct balls from human faeces used as bait in pitfall traps set at Mt. Glorious in southern Queensland (A. Hiller, pers. comm.). *A. matthewsi* is quite adept at ball formation in a manner essentially like that described by Halffter and Matthews (1966) as typical of the tribe, although the time taken (120 minutes) is somewhat longer than that recorded by those authors as normal (12–40 minutes). The genus *Cephalodesmius* uses the same method of ball formation until the rough ball is pinched off the mass, but does not undertake smoothing and enlarging before transport (Monteith and Storey 1981). The genus *Canthonosoma* (*castelnaui* Harold) has been observed by the author near

Blackbutt in southeastern Queensland to congregate on bovine dung, fashioning balls and rolling these away though no detailed notes were made on the procedure at the time.

Matthews (1974) observed the West Australian mentophiline genera *Mentophilus* and *Coproecus* rolling marsupial pellets using Position II, which is that recorded here for *A. matthewsi*. Halffter and Matthews (1966) described the normal 'pushing' position as head down with most pushing on the ground being done by the forelegs, occasionally the middle pair. *A. matthewsi* differs in primarily using the head to push on the ground, occasionally the forelegs. This is similar to that described for *Sisyphus* by those two authors.

It would seems from these few observations that detailed field studies of some of the common mentophiline genera will be necessary before further conclusions can be drawn on the behavioural antiquity of the group.

Some comment should be made on the apparent highly localised nature of the population of *A. matthewsi*. Extensive trapping for dung feeding beetles by a number of collectors has been undertaken in northern Queensland in recent years, from Bloomfield south to Paluma. It seems highly unlikely that such a conspicuous species, which is really quite common at the type locality and apparently active most of the year, would be missed elsewhere, if present. It is possible that *A. matthewsi* could be found in similar habitat about 40 km to the south in the mountains behind Mossman which have as yet received little close study. However, until evidence to the contrary is obtained, we can only conclude that this species has one of the most restricted distributions of any Australian scarabaeine, comparable to some of the larger pterostichine carabids (*Nurus* etc.). It is indeed fortunate therefore that the site is protected within Cape Tribulation National Park.

ACKNOWLEDGEMENTS

The author wishes to thank Mr Geoff Thompson and Miss Gudrun Sarnes of the Queensland Museum for the drawings in Figure 1 and scanning electron micrographs in Figure 2 respectively, Dr Geoff Monteith, Queensland Museum and Mr Tom Weir of CSIRO, Canberra for loan of specimens and comments on the manuscript, Professor Henry Howden, Ottawa and Dr Eric Matthews, Adelaide for their comments on the taxonomic relationships of the species discussed, and Mr Tony Hiller, Brisbane for his observations on *A. maximus*.

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